

BILINGUAL VOCABULARY DEVELOPMENT AND MEMORY AS A FUNCTION OF AGE

*Mansi Mathur, **Shivani Tiwari, & ***Rajashekar Bellur

Abstract

Working memory like in first language acquisition plays a crucial role in learning the second language also. However the role of different memory measures in vocabulary development for bilinguals as a function of age is not known. In this context present study aimed at investigating and comparing the relation of different memory measures (phonological, verbal working and semantic) with vocabulary in younger and older Hindi-English sequential bilingual children. Sixty children in the younger bilingual group (5 to 7.11 yrs) and forty in the older bilingual group (8 to 10.11 yrs) participated in the study. Nonword repetition, digit span and word span tasks as memory measures and category generation as vocabulary measure were administered separately in the two languages (L1-Hindi, L2-English) of the participants. The results showed a similar pattern of performance on memory in relation to vocabulary development in the two languages across age. These findings thus maintain the view of interdependent development of the two languages in bilinguals. The association between the memory performance and vocabulary was found to be significant for the younger but not older bilingual group. Thus, the findings support the literature on memory role in early vocabulary development in bilingual children. Future research is needed to examine these memory aspects at different stages of bilingual development in typical as well as clinical population to better understand the interaction between the two.

Key words: Working memory, sequential bilingual, category generation

The development of language in children exposed to two or more languages has been a topic of growing interest in past few decades. Research data has demonstrated that bilingualism enhances the cognitive flexibility (Cummins, 1976; Diaz, 1983). Children as young in the preschool stage learn contextual use of languages (Lanza, 1992). The two languages in bilingual children can be learned either simultaneously from infancy (simultaneous bilingualism) or sequentially, when a second language is introduced after the first language is well established (McLaughlin, Blanchard & Osanai, 1996; Watson, 1996).

Most bilingual children make unequal progress in acquiring the two languages. This depends on several factors as what language is being spoken to the child, how often it is being spoken and by whom, and on the opportunities the child has to use one language or the other (Goodz, 1994). Thus,

bilingualism in children is complex and highly individual.

Vocabulary development in bilinguals

Studies examining lexical development in bilingual children report similar patterns and rate of vocabulary acquisition as that of monolingual children (Genesee, 2003; Patterson & Pearson, 2004). The relative vocabulary size in each language of a bilingual is dependent on the relative amount of time spent in each language (Pearson, Fernandez, Lewedag & Oller, 1997). The similarity in acquisition of the two languages in bilinguals could be explained in terms of the *linguistic interdependence principle* (Cummins, 1979, 2001).

This principle postulates that linguistic proficiency is common and interdependent across languages. As a result, cross-language transfer of these skills is expected. Peña, Bedore and Zlatic-Giunta (2002) investigated the lexical-semantic

*Student, Department of Speech and Hearing, Manipal College of Allied Health Sciences, (MCOAHS), **Asst Prof., Department of Speech and Hearing, MCOAHS, Manipal-576104, email: tiwarishivani.2009@gmail.com, ***Dean, MCOAHS, Manipal-576104.

organization in Spanish-English bilingual children of 4 to 7 yrs old using the category generation paradigm (Nelson & Nelson, 1990). Similar to monolingual peers, the bilingual children showed a shift in productivity from script-based (slot-filler) condition to a taxonomic condition. Moreover bilingual children generated a comparable number of category exemplars in each language (Spanish, English) under each condition (slot filler, taxonomic) and for each category (animal, food, and clothing), indicating similarity in rates of semantic development between the two languages.

Working memory (a temporary processing and storage of information) plays a crucial role in learning a second language. Research suggests that verbal working memory tasks may be useful to predict L2 acquisition (Service, 1992). For instance, the ability to repeat words in an unknown language has been observed to predict success in learning that language (Ardila, 2003). On the other hand, decreased digit span and inability to repeat pseudowords have been related to failure in L2 acquisition (Ganschow, Sparks, Javrosky, Pohlman & Bishop-Mabury, 1991). Further, word span and semantic span have also been implicated in learning the second language. However, these measures have seldom been studied in developing bilinguals.

Thus, present study aimed at examining the memory measures in relation to vocabulary (category generation task) in the two languages of Hindi-English bilingual children. This particular association between memory and vocabulary was measured as a function of age across younger and older bilingual children.

Method

Participants

A total of 100 children participated in the study. 60 children of age 5 to 7.11 yrs comprised the younger bilingual group and another 40 children of age 8 to 10.11 yrs comprised the older bilingual group. All children were early sequential bilinguals with Hindi as their mother tongue and English as the second language, with minimum age of exposure in L2 being 3-4 yrs. All children were recruited from schools with English as the medium of instruction. Participants obtained a score of 3 and higher for the two languages on a 5-point language proficiency rating scale given by Gutierrez-Clellen and Krieter (2003). All participants were screened for any

complaints of hearing loss, cognitive deficits and/or history of speech and language problems.

Test measures

Memory measures such as phonological memory (non word repetition), verbal working memory (digit span test) and semantic memory (word span test) were studied in relation to vocabulary (using a category generation task) in the two languages of the participants.

Non word repetition: This test was used as a measure of Phonological Memory. A list of 9 non words were used in the study comprised of three 1 syllable, 2 syllable and 3 syllable words each. In English, the word list was adapted from non words developed by Hoff and McKay (2005). In Hindi, the word list was generated with the help of a linguist and fellow speech-language pathologists. A pronunciability check was done by three native Hindi speakers for the various non words in Hindi based on a 3-point rating scale from 0-2 and words rated as pronounceable by all three speech language pathologists were chosen for the study. These non words were audio recorded and presented to the children using the laptop computer using speakers. Participants were instructed to repeat the stimulus after every presentation. The syllables correctly repeated for every nonword by participants was given a score 1. The maximum score for the task was 18.

Digit span test: This test was used as a measure of Working Memory. This measure of randomized digit test used in the study is an adaptation from Binet-Kamath Test (Venkatesan, 2002). The children were presented with a recorded list of numbers. The length of the digits increased from 3 to 9 and the numbers ranged from 1-9. The digits were audio recorded and presented through laptop to the children. Participants were instructed to repeat the numbers in the same order after each presentation. The score given was the maximum span of digits which were correctly produced by the child in the correct order. The maximum score for this task was 9 and the minimum score was 3.

Word span test: This test was used as a measure of Semantic Memory. A list of semantically unrelated words was presented to the children and they were asked to repeat it in the respective order. English words were taken from Hoff and McKay (2005). Hindi word list was generated with the help of a linguist and fellow speech language pathologist. A familiarity check was done by three native Hindi speakers for

the various words in Hindi on the basis of a 3-point rating scale from 0-2. Words rated as familiar by three speech language pathologists were included in the list. The length of the words increased from 3 to 9 in the list. These words were also audio recorded and presented through laptop to the children. The children were instructed to repeat the words in the same order after each presentation. The score was the maximum span of words which was correctly produced by the child in correct order. The maximum score was 9 and the minimum score was 3.

Category generation task: This task was used as a measure of vocabulary in the two languages. In this task the children were instructed to give the names of as many items in one category as possible. Five different categories were used for this task namely animals, fruits, vegetables, common objects and vehicles. Every item produced in a category was given 1 point each. Individual points of each category were summed up to obtain the total score for category generation task.

Procedure

The testing was carried out in a quiet situation. The stimuli were presented through laptop computer using speakers. The responses obtained from the participants were recorded on paper and were scored according to each task.

Results

This study aimed at examining and comparing the relation between memory and vocabulary measures in younger and older Hindi-English sequential bilingual children. Table 1 provides the descriptive statistics for performance on memory

measures and the vocabulary task across the two languages of the participants.

Figure: 1 depicts the performance trend of participants on memory and vocabulary measures in the two languages. The older bilinguals over performed the younger bilingual group in terms of memory measures. It was observed that performance on nonword repetition task reached the maximum level for the older bilingual group. Further performance on digit span and word span tasks also improved with age, though did not reach the maximum level. The performance on vocabulary measure (category generation) however did not show a significant improvement with increasing age.

Participants from younger bilingual group showed superior performance on various memory measures in English than in Hindi language. However, their performance on those memory measures was similar for the older bilingual group across the two languages. Further the association between performances on memory and vocabulary tasks in Hindi and English languages for the two groups of participants was tested using a Spearman correlation.

The results of correlation analysis between the memory measures (nonword repetition, digit span and word span) and vocabulary task (category generation) showed significant positive correlation in Hindi and English languages for the younger bilingual group. However no correlation was observed for the older bilingual group in either language (Table 2).

Language		Task	Younger bilinguals		Older bilinguals	
			Median	Inter-quartile range	Median	Inter-quartile range
Hindi	Memory measures	<i>Nonword repetition</i>	13	5	18	1.75
		<i>Digit span test</i>	4	1	6	2
		<i>Word span test</i>	4	2	5	1
	Vocabulary measure	<i>Category generation</i>	38	21.25	35	10.25
English	Memory measures	<i>Nonword repetition</i>	14	4.75	18	2
		<i>Digit span test</i>	5	1	6	2
		<i>Word span test</i>	4	2	5	2
	Vocabulary measure	<i>Category generation</i>	37	21.25	36	10

Table 1: Descriptive statistics of the performance on memory and vocabulary measures in the two languages

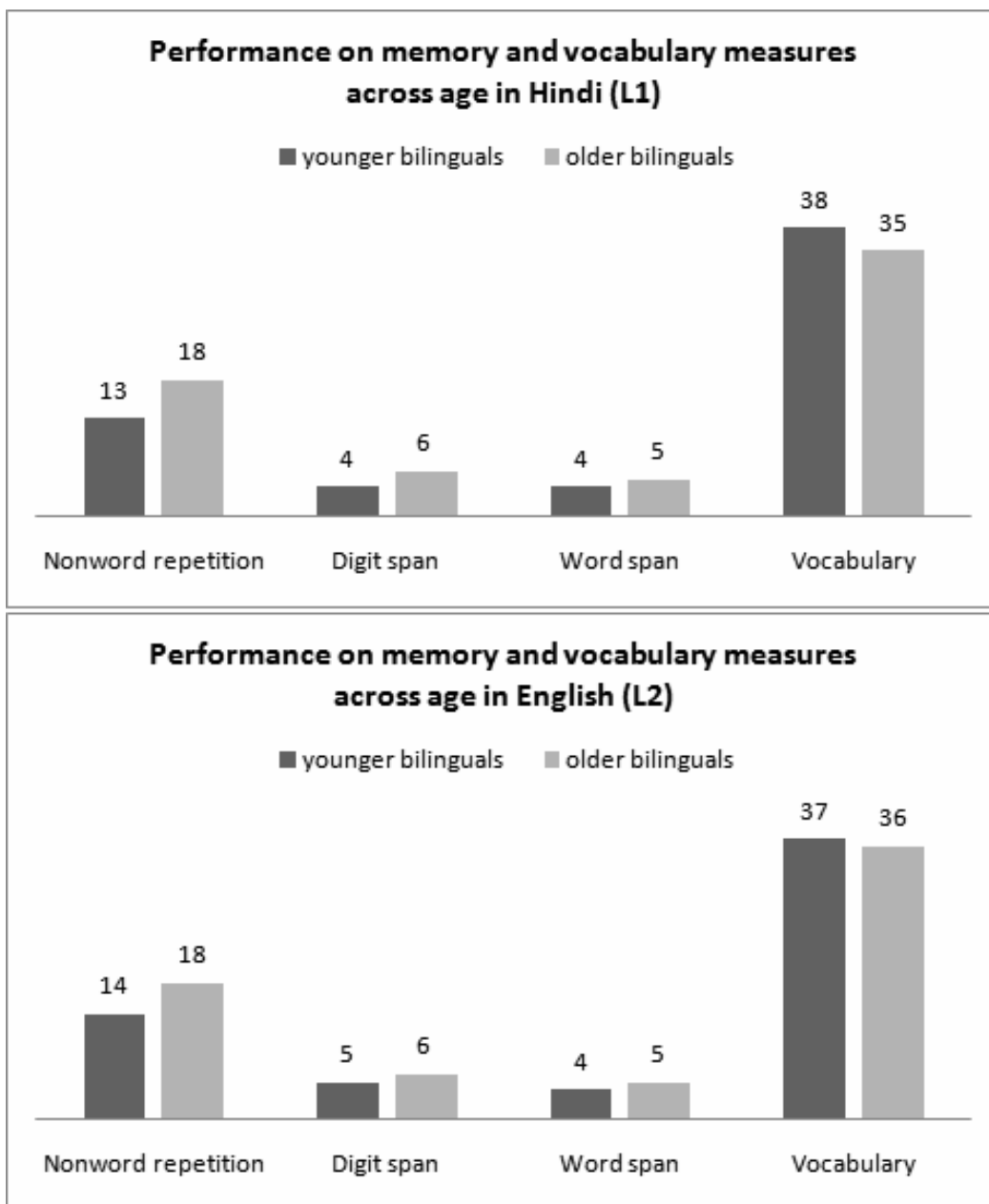


Figure 1: Performance trend on memory and vocabulary tasks

Group	Language	Nonword repetition	Digit span test	Word span test
Younger bilingual	Hindi	0.58*	0.61*	0.67*
Younger bilingual	English	0.56*	0.57*	0.64*
Older bilingual	Hindi	0.05	-0.10	-0.14
Older bilingual	English	0.23	0.06	-0.13

Table 2: Correlation of memory measures with vocabulary task in two languages

Discussion

Adequate and appropriate development of language in children is one of the key feature which accounts for their normal development. Many factors are responsible for language to develop adequately

in a child. One such factor is cognition. In the field of bilingualism, researchers have proposed that the cognitive development in bilingual children is different from those of monolinguals, though the research has been limited in this regard. More elaborately, memory

is one such cognitive feature which is responsible for language development in children (Baddeley, 2003). Literature indicates that various components of memory are important for second language development, like, phonological memory (Thorn & Gathercole, 2001; Service, 1992), working memory (Service, 1992) and semantic memory (Ardila, 1995).

The present study thus aimed at investigating the performance trend on different memory measures like phonological memory, working memory, semantic memory and vocabulary (category generation) in younger and older Hindi-English bilingual children and to find the association between different memory measures on vocabulary in these children. Non word repetition, Digit span test and Word span test were used as measures of phonological memory, working memory and semantic memory respectively. Category generation task was used as a measure of vocabulary. The performance on memory and vocabulary tasks was compared for younger and older bilingual children across the two languages. Results indicated that older bilingual participants outperformed younger bilingual participants on all memory measures as nonword repetition, digit span and the word span tasks. However, participants in both groups demonstrated comparable performance on memory measures across the two languages.

Our study findings showed a developmental trend in participants' performance on phonological memory task across age. Durgonoglu, Naggy and Bhatt (1993) reported that phonological memory is dependent on phonological awareness ability. The better performance obtained by older bilinguals in our study thus indicate that their phonological awareness skills are more developed in comparison to younger bilinguals, who are still developing their phonological awareness skills. Also, participants' performance being similar across the languages by both groups suggest that phonological awareness skill is a cognitive skill that develops simultaneously in children regardless of their monolingual or bilingual oral development (English, Leafstedt, Gerber & Villaruz, 2001). A similar trend was observed for participants' performance on digit span task wherein older bilinguals performed better on digit span task indicating better working memory skills. The performance on working memory measures is mostly dependent on the demands placed on the central executive system (Baddeley & Hitch, 1974). Superior

performance by older bilingual group thus suggests their central executive system works in a more developed manner as compared to younger bilinguals. Further, digit span performance in English (L2) being similar to that observed in Hindi (L1) language indicates that the processing of L2 might share the same executive system of working memory as the processing of L1 (Harrington & Sawyer, 1992). Children's performance on semantic memory measure was also found to be parallel other memory measures. Older bilinguals performed better in comparison to younger group. These findings collectively suggest that semantic memory is more developed in older than younger bilinguals. The developmental trend reflected in participants' performance suggests their ability on semantic memory was still developing. This finding is line with the available literature, wherein Cohen and Stewart (1982) also found that older children had improved ability to correctly recall presented words, as compared to younger children. These observations thus imply that bilingualism facilitates increased recall outputs, and that benefits are associated with age. Similar performance by the participants on semantic memory task in two languages further support parallel development in bilinguals' first and second language lexical-semantic skills (Sheng, McGregor & Marian, 2006).

Participants from both group performed similarly on category generation task in the two languages. This is in accordance with findings of PenPa et al. (2002). It can be attributed to the fact that sequential bilingual children are at an advantage at learning second language. This finding could be explained by Cummins' (1976) notion that a native language foundation can serve as a support for learning English as a second language and also helps in making the learning process easier and faster. According to Cummins (1979) the amount and quality of first language use in the home have been shown to be associated with student readiness for the academic demands of schooling and continued primary language development in the school. The findings that both the groups of participants had a low mean score of their total vocabulary skills may be accounted for the limited exposure to a rich and varied vocabulary (Epinosa, 2006). If the children speak one language in the home and are learning English at preschool, the child may also know some

words in one language and not the other.

Our study results also showed significant correlation of memory measures with vocabulary task for the younger bilingual group, though such a correlation was not observed for the older bilingual group. The role of phonological memory in vocabulary development is well established in the literature. The link between vocabulary knowledge and non word repetition is typically strongest during the early stages of acquiring a particular language (Gathercole, 2006). Vocabulary and non word repetition scores were found to be highly correlated with one another in 4-8 years old children (Gathercole & Baddeley, 1989; Gathercole, Willis, Emslie, & Baddeley, 1992). Non word repetition ability has been shown to be an excellent predictor of language learning ability in children learning English as a second language (Service, 1992; Service & Kohonen, 1995). Thus the positive correlation found between the nonword repetition and vocabulary task for the younger bilingual subjects in the two languages (Hindi and English) in our study could be explained on these grounds.

A similar performance trend was observed for digit span and word span in relation to vocabulary for the younger bilingual group. Considerable evidence is available indicating short term working memory plays a crucial role in supporting the long-term learning of the sound patterns of new words involved in the acquisition of both native and foreign languages (Baddeley, Gathercole & Papagno, 1998). Lanfranchi and Swanson (2005) showed that children with higher English and Spanish vocabulary had higher scores on English and Spanish working memory measures respectively, when compared to those with lower vocabulary. The authors justified their findings as- a better working memory will result in better vocabulary development. Also, Harrington (1991) and Harrington and Sawyer (1992) in their study reported a moderate relationship between working memory performance in a second-language (English) reading span test and the second-language proficiency of Japanese children. The significant association observed between memory measures and the vocabulary task in our study thus support the fact that memory has a crucial role to play in vocabulary development (known in monolingual children) in both the languages of bilingual children.

Furthermore, this association is prominent during the early years of the language development.

Summary

To summarize, findings of this study show that the performances on memory improved with age in bilingual children. Parallel trend observed in the development of memory and vocabulary skills in the two languages of Hindi-English early sequential bilingual children, thus support the interdependent development of two languages in bilinguals. Further, the association between memory measures and category generation was found to be significant in younger but not older bilingual children thus indicating the significance of memory in early vocabulary development.

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